

CHAPTER 1

INTRODUCTION

1.1 GENERAL BACKGROUND

The project concerned on the experiment that is to determine the effect of thickness ratio and loading direction on fatigue properties of tailor welded blanks (TWBs). To imitate the actual TWB panels, method of welding two small panels with different thickness and loading direction are done. Two tests are conducted that is fatigue and tensile test. Fatigue properties are an integral part of materials comparison activities and offer information for structural life estimation. Fatigue test is conducted in a rotating bending stress with constant amplitude until the specimen failed. A fatigue failure usually originates at a point of stress concentration such as notch and connecting rods. On the other hand, tensile test reveals the mechanical properties of strength on the welded joints. The welded specimen is pulled to failure in a relatively short time at a constant rate. Fatigue crack propagation and deformation of the specimen analyses were performed in order to discuss the effect on properties of TWB.

1.2 PROBLEM STATEMENT

TWB is a potential process to reduce general weight in automotive parts. It offers an opportunity to reduce weight and overall cost. Formability characteristics of TWBs are affected by weld conditions such as weld properties, weld orientation and weld location, thickness difference and strength difference between the sheets. It has evidence regarding the welded joints due to welding procedure does have influence on fatigue and tensile strength.

However, the effect of thickness ratio and loading direction on the tensile strength on TWB remain unclear. Therefore, the current work will focus on tensile test of specimen with angles of 90° and 45° to the weld line, in order to clarify the influence of loading directions and different in thickness. Other than that, the fatigue test concern on the fatigue behavior of the welded joints. That method is used to measure fatigue life of the specimen. Through the study, specimens are fabricates using a welding process and procedure depend on the certain thickness and loading direction thus investigate the fatigue and tensile properties of TWB.

1.3 OBJECTIVES

The objectives for this study are:

- To investigate the effect of thickness difference and loading direction on the tensile behavior.
- To evaluate the fatigue strength of the materials used.
- To clarify high quality weld obtained by using tungsten inert gas (TIG) welding.
- To define the microstructures on the welded joints.

1.4 SCOPES

The scopes of project are explained in detail as below:

- 1045 medium carbon steel is used.
- TIG butt joint welding with parameter 45 A and 13 V are used.
- Fatigue test is conducted to investigate the fatigue behavior of welded joints. The maximum value $F= 250\text{ N}$ is used as the initial measure to get the number of load cycles.
- Tensile test is conducted to investigate the tensile strength of welded joints. The cross head speed applied during the test is 1 mm/min.
- Different thickness (2 mm/3 mm) and loading direction (90° and 45° towards loading direction) of specimens are prepared for the tensile test.

- The fracture surface is analyzed by using scanning electron microscope (SEM).
- The microstructure constituents in the weldment are analyzed by using optical microscope to distinguish the defects and grain boundaries.